

**CLAIMS**

1. Method of coating a substrate surface comprising the steps of:
  - preparing several powder mixtures of different chemical composition,  
5 wherein at least one of said mixtures comprise a non-hydrated  
hydraulic ceramic powder binder phase,
  - pre-treating the surface of a substrate, to increase the adhesion  
between the substrate and the ceramic coating,  
10
  - applying layers of said non-hydrated powder mixtures on top of each  
other on the substrate, and
  - hydrating the different powder layers utilizing a curing agent.  
15
2. Method of coating a substrate surface according to claim 1,  
**characterised in that** the step of preparing a powder mixture further  
comprises adding particles or powder of one or more biocompatible  
materials composed of particles or powder of one or several phases  
20 containing phosphates, fluorides or carbonates, calcium carbonate,  
calcium phosphate, apatite, fluoroapatite, carbonates-apatites,  
hydroxyapatite and phosphorous glasses of good biocompatibility.
3. Method of coating a substrate surface according to claim 1,  
25 **characterised in that** it further comprises the step of adding a non-  
hydraulic filler comprising calcium titanate or any other ternary oxide  
of perovskite structure according to the formula  $ABO_3$ , where O is  
oxygen and A and B are metals, or any mixture of such ternary oxides,  
said filler being present in an amount of less than 30 vol.%, preferably  
30 less than 10 vol.% of the total volume of the ceramic ingredients.
4. Method of coating a substrate surface according to claim 1,

**characterised in that** the step of preparing a powder mixture includes reducing the powder grain size, preferably such that it is below 10  $\mu\text{m}$  and more preferably between 0.1 and 3  $\mu\text{m}$ .

- 5        5. Method of coating a substrate surface according to claim 1,  
**characterised in that** the pretreatment of the substrate is performed by blasting its surface with hard particles.
- 10       6. Method of coating a substrate surface according to claim 1,  
**characterised by** the step of embedding fragments or powder of a hydraulic ceramic, preferably of calcium aluminate in the substrate surface.
- 15       7. Method of coating a substrate surface according to claim 6,  
**characterised in that** the embedding is performed by blasting the substrate surface with fragments or powder of a hydraulic ceramic, preferably with calcium aluminate.
- 20       8. Method of coating a substrate surface according to claim 1,  
**characterised in that** a pretreatment of the substrate surface to a surface roughness in the range of  $R_a$  0.1 to 10.0  $\mu\text{m}$  is performed before deposition of the powder mix.
- 25       9. Method of coating a substrate surface according to claim 1,  
**characterised by** the step of pre-treating the substrate surface with an accelerator-agent for accelerating the hardening process.
- 30       10.      Method of coating a substrate surface according to claim 1,  
**characterised in that** the powder layer is applied by a thermal spray technique, PVD or CVD deposition techniques, or applied as a tape prepared by tape casting.

11. Method of coating a substrate surface according to claim 1,  
**characterised in that** the applied non-hydrated ceramic powder  
layer/layers are compacted prior to the final hydration.
- 5 12. Method of coating a substrate surface according to claim 11,  
**characterised in that** the compacting is achieved by using cold  
isostatic pressing (CIP), hot isostatic pressing (HIP), or by passing a  
laser beam across the surface.
- 10 13. Method of coating a substrate surface according to claim 12,  
**characterised in that** the degree of compaction of the powder layer is  
increased between 30 and 80 % and the porosity reduced to 30-45  
vol%.
- 15 14. Method of coating a substrate surface according to claim 1,  
**characterised in that** it further comprises the step of adding a  
dispersing agent to the powder material, e.g. selected from the group  
comprising water, alcohols, oils, acetone, other hydrocarbons, and  
plasticizers.
- 20 15. Method of coating a substrate surface according to claim 1,  
**characterised in that** the step of curing comprises using a curing  
agent in the form of a liquid or a gas.
- 25 16. Method of coating a substrate surface according to claim 1,  
**characterised in that** the curing agent is a water solution or water  
vapour.
- 30 17. Method of coating a substrate surface according to claim 1,  
**characterised in that** the step of hardening the ceramic coating  
comprises addition of a component which accelerates or retards the  
hardening process.

18. Method of coating a substrate surface according to claim 1,  
**characterised in that** the step of hardening comprises controlling the  
temperature to be in the range of 0°C to 100°C, preferably in the range  
20°C to 70°C.
19. Method of coating a substrate surface according to claim 1,  
**characterised in that** the deposited coating has a thickness in the  
order of 0.1-500 µm, and preferably less than 50 µm.
20. Method of coating a substrate surface according to claim 1,  
**characterised in that** the non-hydrated hydraulic ceramic powder is  
essentially calcium aluminate, calcium silicate or calcium sulphate or  
mixtures thereof.
21. Method of coating a substrate surface according to claim 1,  
**characterised in that** the substrate is Ti or alloys thereof, stainless  
steel, Co-Cr alloys, another biocompatible metal, polymeric or ceramic  
material, or any combination thereof.
22. Biocompatible coating, **characterised in that** the coating  
comprises  
a binding layer in contact with the substrate comprising mainly  
hydrated calcium aluminate particles of less than 2 µm,  
a bulk layer comprising mainly hydrated calcium aluminate  
having a grain size between 3 and 30 µm , and  
an outer layer comprising a bioactive or biocompatible material,  
preferably calcium phosphate, apatite, calcium carbonate or  
calcium fluoride.

23. Biocompatible coating according to claim 22, **characterised in that** the coating is capable of carrying drugs.

5 24. Surface coated device, comprising a substrate and a surface coating covering at least a section of the substrate surface, **characterised in that** the surface coating is a biocompatible surface coating made by using the method comprising the steps of:  
-preparing several powder mixtures of different chemical composition, wherein at least one of said mixtures comprise a non-hydrated  
10 hydraulic ceramic powder binder phase,

-pre-treating the surface of a substrate, to increase the adhesion between the substrate and the ceramic coating,

15 -applying layers of said non-hydrated powder mixtures on top of each other on the substrate, and

-hydrating the different powder layers utilizing a curing agent.

20 25. Surface coated device according to claim 24, **characterised in that** the substrate is Ti or alloys thereof, stainless steel, Co-Cr alloys, another biocompatible metal, polymeric or ceramic material, or any combination thereof.

25 26. Surface coated device according to any of the claims 24, **characterised in that** it is a medical device, medical device for implantation, artificial orthopedic device, spinal implant, joint implant, attachment element, bone nail, bone screw, or a bone reinforcement plate.

30 27. Surface coated device according to any of the claims 24, **characterised in that** the surface coating is the biocompatible surface

coating comprising:

a binding layer in contact with the substrate comprising mainly hydrated calcium aluminate particles of less than 2  $\mu\text{m}$ ,

5

a bulk layer comprising mainly hydrated calcium aluminate having a grain size between 3 and 30  $\mu\text{m}$ , and

10

an outer layer comprising a bioactive or biocompatible material, preferably calcium phosphate, apatite, calcium carbonate or calcium fluoride.